

DIFFERENCES IN EARNINGS ACROSS SEX AND EDUCATIONAL ATTAINMENT: COMPARING BOX PLOTS

Activity Item

The following item is part of this activity and appears at the end of this student version.

- Item 1: Box Plots

Student Learning Objectives

- I will be able to interpret a box plot.
- I will be able to compare different variables across data sets.
- I will be able to compare box plots to make claims and inferences based on the data.

Item 1: Box Plots shows national median earnings — for all 50 states and the District of Columbia — for men and women aged 25 and older whose highest levels of educational attainment are either a high school diploma (or equivalent) or a bachelor's degree.

Inspect the two sets of box plots. Now use them to answer the following questions.

1. Compare the median earnings for people whose highest level of education is a high school diploma or equivalent with those for people whose highest level of education is a bachelor's degree. What observations can you make by just looking at the data? Justify your claim.
2. Compare the median earnings of men and women. What observations can you make by just looking at the data? Justify your claim.
3. Estimate the values for each of the measures (minimum, first quartile, etc.) in **Item 1** and show your work below for men whose highest level of education is a high school diploma or equivalent, using the relevant box plot.
4. Estimate the values for each of the measures for women whose highest level of education is a high school diploma or equivalent, using the relevant box plot.

5. Estimate the values for each of the measures for men whose highest level of education is a bachelor's degree, using the relevant box plot.

6. Estimate the values for each of the measures for women whose highest level of education is a bachelor's degree, using the relevant box plot.

7. Compare the minimum median earnings for men whose highest level of education is a bachelor's degree with the third quartile of median earnings for women whose highest level of education is a bachelor's degree. Explain what this means in context.

8. Compare the third quartile of median earnings for men whose highest level of education is a high school diploma or equivalent with the first quartile of median earnings for women whose highest level of education is a bachelor's degree. Explain what this means in context.

9. Compared with the 50 states, the District of Columbia is an outlier in this data set in terms of median earnings for women whose highest level of education is a bachelor's degree (represented by the second * in **Item 1**). Examine the relevant box plot to answer the following questions about outliers.
- Estimate the value of this outlier.
 - For a value to be considered an outlier, it must be greater than $(1.5 \times \text{IQR}) + Q_3$ or less than $Q_1 - (1.5 \times \text{IQR})$. Verify below, showing your work, that your estimate from question 9a would qualify as an outlier (use estimates of quartiles).
 - Why do you think the median earnings for women in the District of Columbia whose highest level of education is a bachelor's degree are noticeably greater than the median earnings for women of the same education level in the nation as a whole?
 - Describe the impact of this outlier on the mean, median, and shape of the distribution.

10. At which level of educational attainment do the median earnings have the most variability? Explain.

11. Compare box plots to assess the differences in median earnings at each level of educational attainment (use estimates of quartiles):
 - a. How much greater are the median earnings of men whose highest level of education is a bachelor's degree than those of men whose highest level of education is a high school diploma or equivalent?

 - b. Approximately how much more would a man whose highest level of education is a bachelor's degree earn over a 40-year career compared with a man whose highest level of education is a high school diploma or equivalent?

 - c. How much greater are the median earnings of women whose highest level of education is a bachelor's degree than those of women whose highest level of education is a high school diploma or equivalent?

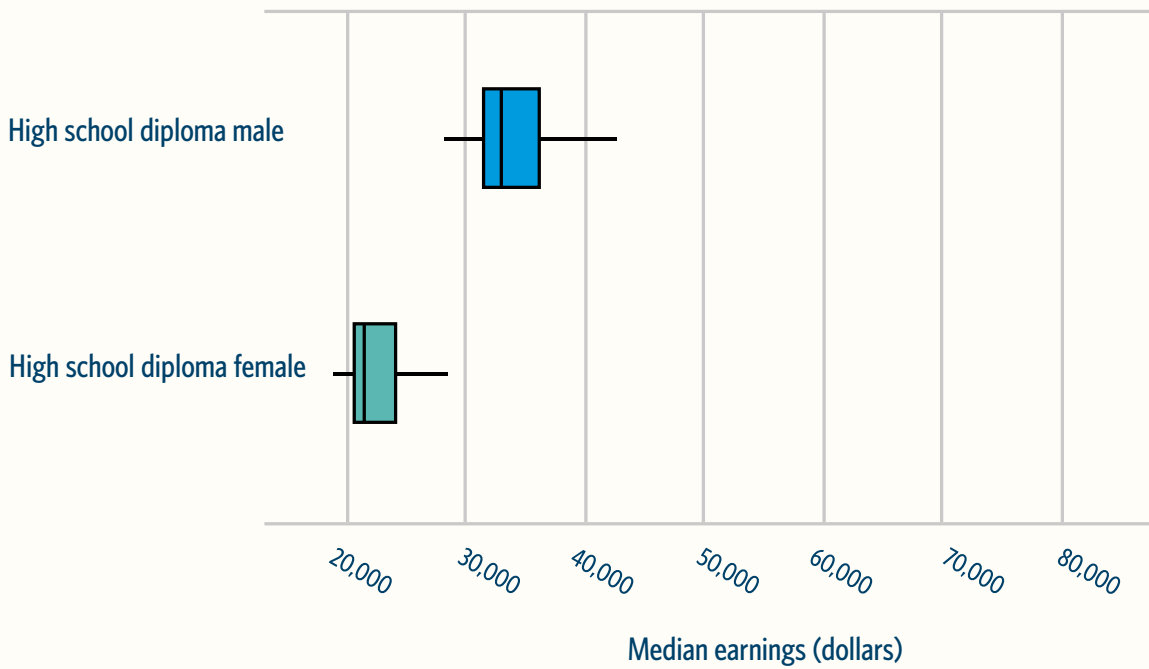
- d. Approximately how much more would a woman whose highest level of education is a bachelor's degree earn over a 40-year career compared with a woman whose highest level of education is a high school diploma or equivalent?
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- 12. Compare box plots to assess the differences between the sexes in terms of median earnings (use estimates of quartiles).
 - a. Among people whose highest level of education is a high school diploma or equivalent, about how much greater are the median earnings for men than those for women?

 - b. Among people whose highest level of education is a bachelor's degree, about how much greater are the median earnings for men than those for women?
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- c. Why do you think women have lower median earnings than men in both of these cases? Keep in mind that the data only relate to women who are in the workforce and exclude homemakers and retirees.

13. Compare the gaps in national median earnings between the sexes and between the levels of educational attainment (use estimates of quartiles).
 - a. In just looking at the data in the box plots, which appears to be greater — the difference in earnings between the sexes or the difference in earnings between the levels of educational attainment? Explain.
 - b. Use math to determine whether your prediction from question 13a is correct or incorrect (use estimates of quartiles). Explain.
14. Evaluate a box plot as a way of displaying a data set.
 - a. What are the advantages of box plots?
 - b. What are the limitations of box plots?

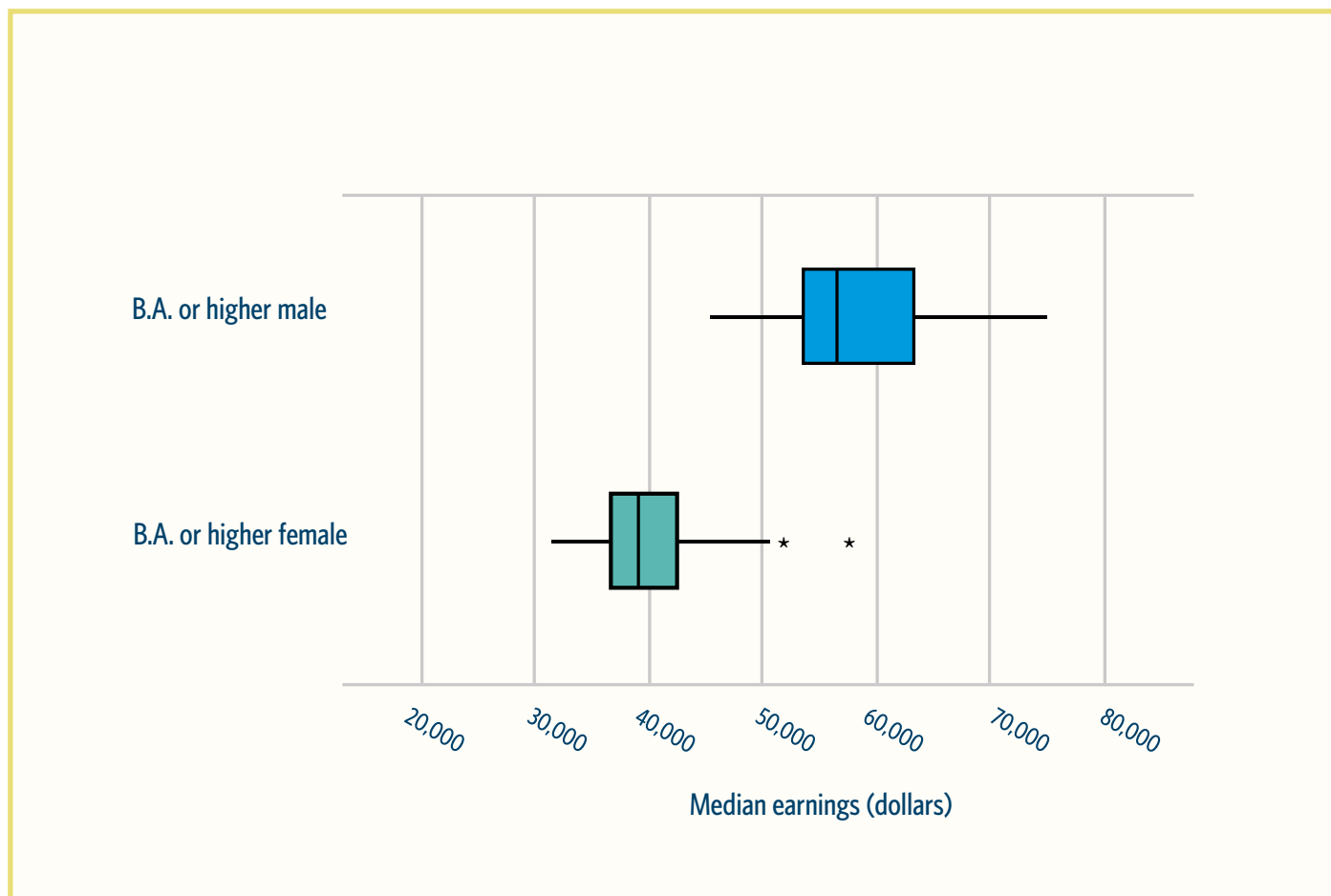
Item 1: Box Plots

Distribution of U.S. State Median Earnings for Men and Women Whose Highest Level of Education Is a High School Diploma or Equivalent



Item 1: Box Plots (Continued)

Distribution of U.S. State Median Earnings for Men and Women Whose Highest Level of Education Is a Bachelor's Degree



Source for data: U.S. Census Bureau, *Median Earnings in the Past 12 Months (in 2013 Inflation-Adjusted Dollars) by Sex by Educational Attainment for the Population 25 Years and Over*.
2009-2013 American Community Survey 5-Year Estimates.